

Figure I. Pag. 19.

A. The Abyfs
 B. The Terraqueous
 Globe.
 C. The vast Sphere
 of Water, sufficient to
 give the sustained Corpus-
 cles of the whole Earth
 a free way to gravitate and
 preponderate, in order to
 form again the Body of
 the Earth, according to
 Dr Woodward's Hypothesis.

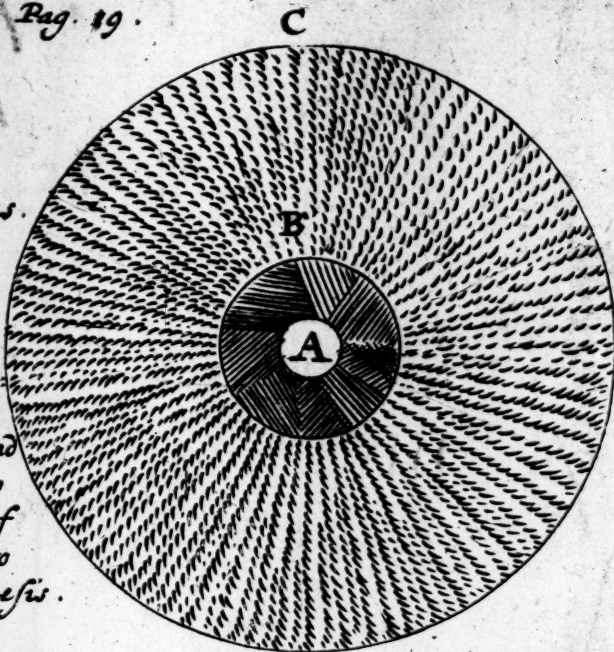


Figure II. Pag. 25.

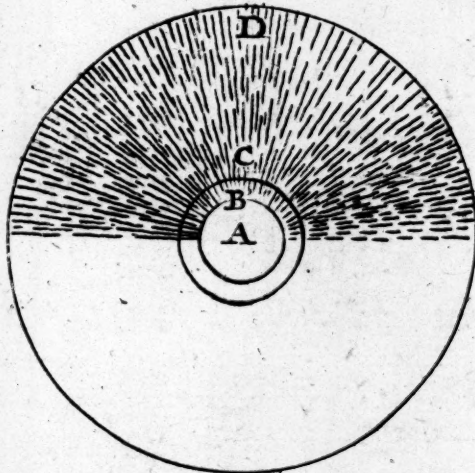


Figure III. Pag. 40.

Main Stem - - -
 Lateral - - -
 Collateral - - -
 Sub-collateral - - -
 Lateral Sub-collateral - - -

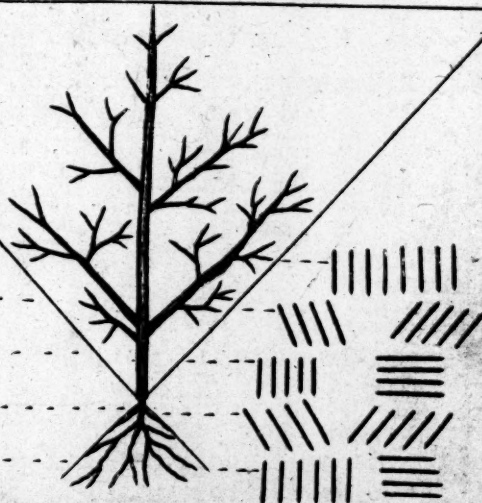


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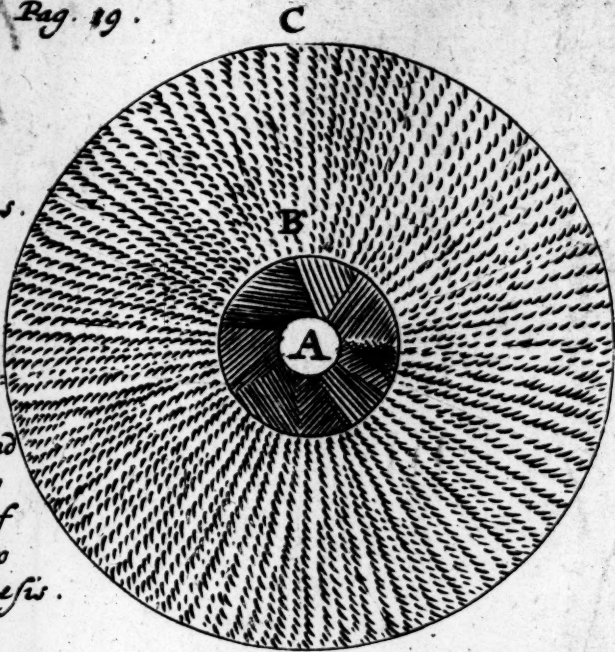


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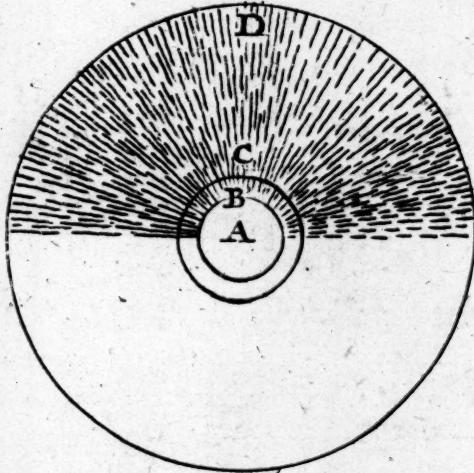
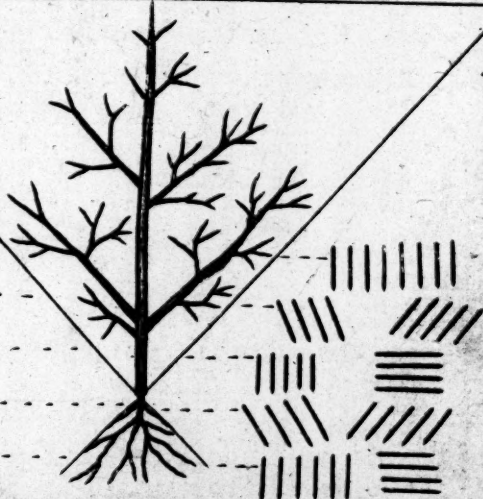


Figure III. Pag. 40.

Main Stem - - -
 Lateral - - -
 Collateral - - -
 Sub-collateral - - -
 Lateral Sub-collateral - - -



AN 1746
ACCOUNT
OF THE 4
Origin and Formation
OF
FOSSIL-SHELLS, &c.

WHEREIN
Is Proposed a Way to Reconcile
the Two Different Opinions, of
those who affirm them to be the
EXUVIÆ of real Animals,
and those who fancy them to be
LUSUS NATURÆ.

*Unus erat toto natura vultus in orbe,
Quem dixere Chaos, rudis indigestaq; Moles,
Nec quicquam nisi pondus iners, congestaq; eodem
Non bene junctarum discordia Semina rerum.*

Ov. Met.

L O N D O N,
Printed by *W. Botham*, for *James Knapton*, at the
Crown in *St. Paul's Church-Yard*. MDCCCV.

Jos: Banks

i



AN
ENQUIRY
INTO THE
ORIGIN
OF
FOSSIL-SHELLS, &c.

SIR,

AMongst the unusual Workings of Nature, the Original and Formation of these pretty and sometimes surprizing Appearances, have of late busied the Heads and exercised the Thoughts of some of our greatest Theorists, to conceive, and to give the World a satisfactory Solution of it.

This if ever it be done, is to be expected from such who have had the Opportunities to make the best Collection of those Figured Substances, and to

B

observe

observe their Matrices and places of existence ; and who have most carefully traced the Impressions of Nature, and have examin'd the Force, Extent and Determination of her Plastick Powers, in other Processes of her Operations : From such we may one day expect, when a long train of new Discoveries and Trials has ripen'd things for it, what upon due Proofs and evident Demonstrations the World may call a general Satisfaction : And what has hitherto been perform'd of this nature, hath, in the opinion of some, rather served to enlarge our Doubts, and to quicken our Inquisitiveness, than to fix or determine our Judgment, as in a solid acquiescible Solution of that Particular : Yet this must in no wise discourage us from offering towards it in the mean time ; for perhaps when the wish'd Conclusion sees the Light, its Birth may be facilitated by every Conjecture that hath gone abroad about it.

The several late Opinions on this Subject, vastly disagreeing between themselves as they are brought to serve several Hypotheses, we may generally sort and distinguish under these two Heads: *viz.*
First,

First, Of those who strenuously contend, that these form'd Substances, Shells, Bones and other peculiar Fossils, are the exuvius Remains and the true and real Parts of Marine Animals, by some extraordinary Fate scattered and left embodied in the several Consistencies of the upper Crust of the Earth ; where mixt with various sorts of Bodies, they came, by means of certain lapidific Juices, to be congealed with them ; leaving there either their Marks and Signatures on their Containing or Contained Concrets ; or else Preserving their Bulk, Figure, and in some places their Frame and Contexture, firm, entire and unaltered to this day.

Secondly, There are other Persons who maintain and warmly avouch, that these form'd Bodies, taken out of the Earth, are indeed the direct and regular Workings of Nature, wherein she sometimes seems to sport and play and make little Flourishes and Imitations of things, to set off and embellish her more useful Structures ; and that those Formations had no other Original, than what her plastick Power exerted in the forming of them, in those very places

B 2 where

where they are found and taken up. These are the two main Heads of the disagreeing Opinions in this Affair ; which, for your satisfaction, I shall first compare and examine severally ; and then, as you desire, shall attempt to propose a middle way to solve the Difficulty, which at least shall be very agreeable with the Order of Nature and the Mechanical Powers of Matter ; which is all I can promise towards the advancing of that general Satisfaction.

The first of these Opinions (I must confess) in the Grounds of it, appears very plain and rational ; but as to the manner of the Conveyance and Dispersion of these exuvius Concrets unto such remote and different places, it must be confess'd to be encumber'd with very great and insuperable difficulties : So also the other Opinion is consonant enough to the Laws and Powers of Nature ; but when we take into consideration the End, Designment and Purposes of Nature in the production of these prettily form'd and little useless Things, it encounters with no small difficulty to support and defend it. For what more obvious than this reflecting Thought, *viz.* To what purpose should

a Tooth be made without a Jaw or Mouth? To what end should a Shell be form'd without an Animal Inhabitant? and to imagine it to no end, would be too mean a thought of the acknowledg'd Prudence and Sagacity of Nature, which she is seen to observe in all her Workings: To fancy her tricking and sporting, is too trivial and lufory, for her severe and rigid Constancy.

Now indeed, tho' we may of the one, very justly and reasonably ask the question, how these Shells, Bones, &c. came to be lodged in those deep and thick *Strata* of Stone and Earth, and found on the highest Mountains, so far distant from their natural Element; and 'tis very true, that without a reasonable and satisfactory account of this, we may as justly reject the Conclusion, that is, deny that they are the true, genuine and real Parts of those very Animals, which they so intimately and undeniably resemble:

Yet of the other Opinion; tho' we cannot give a determinate account, to what end and purposes Nature produced these pretty Resemblances of the parts of living Things; there being very
many

many things obscure and unperceivable in her Designs and Purposes, amongst which this very thing does, and perhaps for ever will (as to us) lye dormant in the Cabinet of her Secrets, after all our most curious Views and Enquiries about it; yet if it may be possible, that She may have some ends in it, it is Ground enough for us to establish the Supposition, *viz.* That Nature is the immediate Parent of them, even in those places in which they are found; and that too, without giving the Atheist any Advantage by it, as some persons have been needlessly apprehensive.

For indeed there will appear upon a just view of the matter, a very great difference between the difficulties which may occur to us, in both these respects; that is, between that of the Instrumental Causes, and that of the Ends and Purposes of Nature. We have in view, and we may inquire into and examine all the material Means and Instruments, by which the Conveyance and Settlement of these Marine-like Substances may be effected, and with which they may have been transported from their native Dwellings to the Beds and
Lodg-

Lodgments where they are now found to rest in ; and if we find and plainly apprehend from the State of Nature, from the Testimony of Sacred Records, and from other Assurances, a manifest impossibility in these Means and Instruments to perform that Work, we may justly deny the Fact : But in the other Opinion, the case is quite otherwise ; we have not there before us, we cannot examine into and calculate all the Ends and Designments of Nature : And if it be possible she may have some ends, tho' unknown to us, in the production and forming of these regular Fossils, we are to accept the Proposition in the main, there appearing no feasible way to infringe and overthrow it.

The first Hypothesis is (I confess) asserted and maintain'd by very Learned and Ingenious Persons ; but as to the manner of that supposed Conveyance of those Fossil Shells from Sea to Land, it involves in it, particularly in some of their Explications of it, such strange Inconsistencies and Abhorrences to the establishment of Nature, that the very naming of them is enough to subvert it.

'Tis true, the Patrons of this Hypothesis have found in the Variety of these Fossils,

Fossils, such appearing Symptoms and Indications of their having once been the Parts and Appurtenances of Animal Marine-bodies, that without manifest violence to their Faculties, they could not choose, on such appearing Probabilities, but assert them such : There frequently appearing, immured in the densest Concretions of Marble, Lime-stone and Chalk, vast numbers of Cockles, Oyster-shells, Escallops, Periwinkles and other variety of Shells, belonging to Seas and Rivers, some of them broken, some entire, being

Dr. Woodward's Essay, Page 22. 23.

(as Dr. Woodward affirms) ‘ precisely of the same Size and Figure, with those now found on the Sea-shores, of the same Substance and Texture, consisting of the same peculiar Matter ; and this constituted and disposed in the same manner as is that of their respective Fellow-kinds at Sea. Nay more, the tendency of the Fibres and Striæ the same and alike in both ; the Composition of the *Lamella* constituted by these Fibres the same in both : the same *Vestigia* of Tendons, by means whereof the Animal is fastened and joyned to the Shell, in each of them.

Besides

' Besides (saith he) these Fossil Shells,
 ' are attended with the ordinary Acci-
 ' dents of the Marine ones : They some-
 ' times grow to one another, the lesser
 ' Shells on the larger ; they have *Bala-*
 ' *ni*, *Tubuli vermiculares*, Pearls, Co-
 ' ral and the like, still actually grow-
 ' ing on them ; and, which is very con-
 ' siderable, they are most exactly of the
 ' same specifick Gravity. Nay farther,
 ' they answer all Chymical Tryals in
 ' the same manner as the Sea-shells do ;
 ' their parts, when dissolved, have the
 ' same appearance to view, the same
 ' smell and taste, they have the same
 ' *Vires* and Effects in Medicine, when in-
 ' wardly administred to animal Bodies :
 ' *Aqua fortis*, Oyl of Vitriol and other
 ' like *Menstrua*, have the very same ef-
 ' fects upon both. In a word, nothing
 can be seen in the true Marine Bodies at
 Sea, but may be paired and sampled in
 the like on Land, except a living Inha-
 bitant.

He farther adds ' That so exactly
 ' conformable to the Marine ones, are
 ' those Shells, Teeth, Bones, which are
 ' digg'd out of the Earth, that tho'
 ' several hundreds of them (which I
 ' now (says he) keep by me) have been
 C ' nicely

' nicely and critically examin'd by very
 ' many learned Men, who are skill'd in
 ' all parts of History, and who have
 ' been particularly curious in, and
 ' conversant with Shells, and other Ma-
 ' rine Productions; yet never any Man
 ' of them went away dissatisfied or
 ' doubting, whether these are really
 ' the very *Exuvia* of Sea-Fishes or not.
 ' Nay, which is more to my purpose,
 ' (adds he) some of the most eminent
 ' of those very Gentlemen who were
 ' formerly very doubtful in this mat-
 ' ter, and rather inclined to believe
 ' that these were natural Minerals, and
 ' who had wrote in defence of that
 ' Opinion; do notwithstanding upon
 ' strict and repeated inspection of
 ' these Bodies in my Collection, and
 ' upon farther inquiry and procurati-
 ' on of plain and unalter'd Shells from
 ' several parts of this Island, fully as-
 ' sent to me herein, and are now con-
 ' vinc'd that these are the Spoils and
 ' Remains of Sea Animals.

These great and pregnant Testimo-
 nies of Similitude between these Marine
 and Terrestrial Products, have induced
 several Persons of this and other Nati-
 ons, as well as Dr. *Woodward*, to be-
 lieve

lieve them all to have one and the same Original: and that those Shells, Teeth, Bones, that are thus found in Stones and Earth, the pieces also and fragments of them, have been the *Exuvie* or spoils of Marine Animals: But to demonstrate how and by what means they came to be so dispersed and lodged in Earth, Rocks and Stones, so far from their natural Element, *Hoc opus hic labor est*, this has extremely perplexed their thoughts and has set some of them on strange attempts to endeavour to loose and solve the Difficulty.

It was plain that nothing but the universal bulk of Water in which these Shells (they say) were generated, could perform this Work; but to convey these Shells into great depths in the firm and compacted Body of the Earth, and there too into the most dense and solid *Strata* of Rocks and Stones, by the only means of this Fluid, into which it naturally has no access, is a difficulty they could not surmount.

The Ingenious Dr. *Hooke* with his Glasses looking further than many others into the Frame and Texture of these Testaceous Bodies, confidently pronounces them to be the Shells of certain Shell-

fishes; but how they came to be intomb-
ed in those hard inaccessible Recesses, it
passed his skill to find out and discover :
He thinks it possible they might be lod-
ged there by some Deluge, Inundation,
Earthquake, or some such like means.
Fabius Columna, *Augustino Scilla*, *Boc-
chone*, Italians; and Mr. *John Ray* and
others are of the same Opinion, and
give us as little Satisfaction in the
point of their conveyance from Sea to
Land, as Dr. *Hooke* has done : Indeed
Nicholas Steno, an *Italian* Author, in
his *Prodromus*, has attempted the Ex-
plication of that *Phænomenon*, but with
such strange and until then unheard of
Paradoxes and Inconsistencies, that
nothing less than a total dissolution of
the Terrestrial Frame must be admitted
to establish the Conclusion.

From this Author, it seems, the fore-
mention'd Dr. *Woodward* took the first
Strokes and Lineaments of his intended
Natural History, in relation to this
Phænomenon: of which History he has giv-
en us a short Draught and Plan, in his
late Essay towards it; wherein he hath
improved that Notion to that accuracy
and seeming probability, that if the
state and Constitution of Nature did
not

not loudly contradict it ; and if the Text of *Moses*, for which he owns all due Veneration, would afford it the Countenance he pretends to ; it would well deserve to be highly accounted of, and we might rest as positive as the Author in the truth and certainty of its Conclusions.

This Gentleman affirms, that during the time of the Universal Deluge or *Noah's Flood*, whilst the Waters were out upon and cover'd the Terrestrial Globe, all the Stone and Marble of the *Antediluvian* Earth : All the Metals of it : All Mineral Concretions ; and in a word, all Fossils whatsoever that had before obtain'd any Solidity, were totally *dissolved*, and their Constituent Corpuscles all disjoined, their *Cohesion* perfectly ceasing ; that the said Corpuscles of these Solid Fossils, together with the Corpuscles of those which were not before Solid, such as Sand, Earth and the like ; as also all Animal Bodies and parts of Animals, Bones, Teeth, Shells ; Vegetables and Parts of Vegetables, Trees, Shrubs, Herbs ; and, to be short, all Bodies whatsoever, that were either upon the Earth, or that Constituted the parts of it, if not quite down

down to the Abyſs, yet at leaſt to the greateſt depth we ever dig; I ſay (ſaith Dr. *Woodward*) all theſe were aſſumed into and promiſcuouſly ſuſtain'd by that Water, in ſuch a manner, that the Water and Bodies in it, made up one common confuſed Maſs.

Then he adds, That at length all the Maſs that was thus born up in the Water, was again precipitated and ſubſided towards the bottom: That this Subſidence happen'd generally, and as could be expected in ſo great a Confuſion, according to the laws of Gravity; That Matter which had the greateſt quantity or degree of Gravity, ſubſiding firſt in order, and falling loweſt; That which had the next, and ſtill a leſſer degree of Gravity, ſubſiding next after and ſettling upon the precedent, and ſo on in their ſeveral Courses: That the matter ſubſiding thus, form'd the *Strata* of Stone, of Marble, of Coal, of Earth, and the reſt; of which *Strata* lying one upon another, the Terreſtrial Globe, or at leaſt as much of it as is ever diſplay'd to view, doth mainly conſiſt. Then he proceeds to ſhew how theſe Shells, Teeth, Bones, and other Marine-like Fossils, being likewise taken
up

up and sustain'd in that great Fluid, came to be disposed in their several Lodgments by their particular Gravities and Inclinations.

This he seems to intimate as the ground-work of his intended Super-structure, by which he supposes to give an undoubted Solution of this difficulty : but in Propositions of this great concern and consequence, he would have done well to have nicely weigh'd and consider'd every important Circumstance of such a Procedure, to have given us more than (I say,) to oblige the World to the belief of such novel Conclusions. He should, one would think, have with great accuracy and diligence pondered and examin'd the relative Properties and Affections of the minute Contained Corpuscles so dissolved, and of the great containing Fluid, the Velocities and *Remora's* of different descending Bodies, their weight and surfaces, and the Moments of time commensurate to the spaces of Motion ; he should have given us plain demonstrative evidence, at least of the possibility of that dissolution, what were the efficient, what the instrumental Causes of it, and have shew'd us Mechanically
and

and experimentally that the Minute constituent parts of any Solids, when reduced to that supposed Smallness, can observe those Laws of Gravity, which the bigger and more heavy Compounds are observ'd to do.

It being so, and that this is the only fair Account we have yet had, that looks like a Reason given of these Fossils being the true and real Spoils of the Ocean, and that they owe their Formation and Being to a Marine extraction, in that manner as Dr. *Woodward* describes it; I shall a little inquire into the validity and consistence of the Parts of that Account; and if by that Enquiry we find it unconsistant to the *Phænomena* of Nature and the Mechanical Laws of Matter, to which it so highly pretends, the whole Superstructure, how speciously soever raised, will of it self totter and fall to the Ground; and the Patrons of that Opinion will be left to seek out some other way to fetch these scatter'd Fossils from their antient Marine Repositories, and to explain it with better Success, to gain assent and approbation in this thoughtful inquiring Age.

First,

First, This Author seems defective in explaining and settling his Terms; that is, in letting us know what he would have to be meant by Total Dissolution and Constituent Corpuscles: If he understands by these general Terms, all solid Bodies to be dissolved into their Granules or visible and palpable Parts, it may be perhaps possible (such a Dissolution being granted) that there might be such a sedimenting and settling of them (as he asserts) according to the Specifick Laws of Gravitation: But if he means a dissolving of them into their *Minima Naturalia*, as they call them, into their invisible and impalpable Parts; I mean invisible every one by it self, which are indeed the prime Constituent Elements; and into such they must be reduced, if, as he affirms, all Cohæson ceased; Then 'tis demonstrable, that Corpuscles so dilated, are as incapable of subsiding in any Fluid, as the Parts of dissolved Copper are, when mixed with the thinnest Liquids; which by their Colour are plainly seen to remain incorporated with the Water in which they are sustain'd: And Gold, we know, the heaviest of all Bodies yet observed.

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will

will not easily subside when dissolved in *Aqua Regalis*, till press'd down and precipitated by another Agent that draws it along with it : Nay, we every day see, that a great proportion of Terrestrial Matter, when reduced to Steam or Vapour (the parts whereof are yet much more gross and bulky, than where all Cohæſion perfectly ceases,) rather ascend than descend, even in a lighter Medium than Water ; the Parts thereof being broken and dissolved to that Exility and Lightness, that, *Quantum pro quanto*, they become lighter than the Air in which they fluctuate. Then how much lighter than Water would these Parts be, if, as Dr. Woodward expresses it, all their Cohæſion perfectly ceased in it ? So far is he out in the main and principal part of his Assertion ; and so unlikely therefore is it, that these Fossil Marine Remains were that way conveyed into their present Repositories, from whence they are now digged out and discovered to us.

Secondly, Granting the Doctor's Corpuscles to be of a larger size than the ultimate Minute Atoms, and that That dissolution he imagines, affected only the
the

the *component Granuli* of the *Antediluvian* Earth, of Stones, Mettals, Minerals, &c. yet these being taken asunder and assumed into an ambient Fluid, how incredibly vast must the Orb and extension of that Fluid be, to contain the diffused and expanded Mass of these dissevered and elated Corpuscles, especially to afford every one of them space and Elbow-room to run their Career and perform their respective Specifick Descents and Gravitations?

Thirdly, That such an Orb and Expansion of Water, as will appear at a moderate Computation necessary to sustain the whole Terrestrial Mass of Matter, and to give to every part of it a full Scope and Latitude to act and perform the said Descents and Gravitations, exceeds possibility in the ordinary State of Things; is made evident by this Demonstration.

A The Abyss.

B The *Terraqueous* Globe.

C The vast Sphere of Water, sufficient to give the Sustained Corpuscles of the whole Earth a

D 2

free

free way to gravitate and preponderate, in order to form again the Body of the Earth, according to Dr. *Woodward's* Hypothesis.

The *Terraqueous* Globe A B, being by the Computation of the late best Mathematicians about 7440 Miles diameter; what proportion the Water bears to the Earth in this Globe, cannot be determin'd: 'Tis conceiv'd by most not to exceed a third part of the Earth's Dimension: The Ancients gave it a much less Allowance. Now if Dr. *Woodward's* Hypothesis be true; the bulk of Water, or that third part of the Globe A B (for he fetches none from Comets) must expand it self to the vast Circumference of the Globe C, being at least 74400 Miles diameter; which is as much as to say, that the same Body of Water should exceed it self above two hundred times.

Now that it must be so, and that the Expansion of a Globe of Water to that vast dimension here ascertained, is necessarily requisite to support his Hypothesis, will appear by this: The whole Body of the Earth (says he) was taken
 asunder

asunder into Minute Parts or Corpuscles,
 and all these taken up and sustain'd for
 some time in an expanded Fluid, and
 afterward leasurely subsided along the
 Central Lines of that Fluid, till they met
 and united and closed again into the
 same *Terraqueous* Globe A B, one Atom
 or Corpuscle after another, as they pre-
 ponderated and were of greater or lesser
 degree of gravity. Now, if so, then it is
 plainly and necessarily requisite, that in
 that *Hydrostatic Mechanism*, in that pro-
 cedure of Gravitation wherein every
 Corpuscle took its place in the Sedi-
 ment according to its specific Gravity;
 there must be allow'd to every Cor-
 puscle a Line of Fluid, of ten times
 its own diameter, to descend in;
 which it must have before it can pre-
 ponderate and out-run others, and
 perform its due Course in that Race
 of Gravitation; And what will this
 amount to? No more than this;
 that if we take but one half of the
 Semidiameter of this Globe (which is
 the least we can assign) to be dense and
 solid Matter, and allow that to be
 1860 Miles of thickness; if a Line
 of Fluid be assign'd of ten times
 that length, (for such it must be to
 give

give to every Corpuscle a space of ten times its diameter ;) then it follows, that to perform this, there must be raised up a Sphere of Water above 74400 Miles diameter ; that is, a Deluge above the highest present Mountains some thousands of Miles of perpendicular height, a space that no less than a hundred thousand Oceans could fill ; a thing sure the Doctor will not affirm.

For if (to evidence the truth of this,) from the Circle A to the Circle B, the thickness of the Terrestrial Crust, it be 1860 Miles, as is here supposed ; then a Line of Atoms from A to B, extended to C, being the decuple Proportion, must have a Semidiameter of Fluid, from C to the Circle A ; which is 18600 Miles, the least we can conveniently assign for every Corpuscle to perform in its Career of Gravitation, as the Hypothesis prescribes : And so it is evident, that the perpendicular of that Fluid Line from C to B, must be nine parts of ten, which is, 16740 Miles above the present Surface of the Earth ; And if a Mass of Water of that prodigious Magnitude rose above any point of the Earthly Globe to that height, it must do so all round it ; the nature of that
Element

Element obliging it to cling together in a Globular Figure, or one very near it.

But yet if any be prevailed upon to think that a less Space of Fluid than ten Diameters to every dissever'd Particle will suffice to perform those acts of Sedimenting which the Hypothesis before us supposes with regard to the powers of Gravitation; and consequently that a lesser Globe of Water than I have computed, may do the work; the force of my Objection will not yet be much abated. I can easily spare a deduction (if the thing would bear it) of three parts of four of my calculation, *viz.* streighten every Corpuscule to two Diameters and a half of Fluid to move in; for to less than that I suppose none will demand it; and yet even so much will require such an Orb of Water above the Surface of the Earth, that some thousands of Oceans would scarce suffice to fill it; which leaves the Matter still as we found it; that is, inconsistent with the Constitution of Nature, in the then and present state of things.

Fourthly, 'Tis to be farther considered, that in case it be granted, that the vast Orb of Fluid, upon the total dissolution

lution of the Earthly Globe, became one promiscuous Blend or Mass of Earth and Water, commixt and jumbled together in great confusion and disorder; 'tis not yet Mechanically conceivable, neither does Dr. *Woodward* in his Essay pretend to shew, how these Teeth, Bones, Shells, and other instanced Fossils had not had their parts likewise dissolved in the same manner, as other Concrets, in that grand Separation; for sure we are (whatever he may fancy of a vegetative Conglutination) that harder and more closely compacted Substances than them which he mentions, were then dissolv'd and macerated. Neither is it conceivable how the elated vagrant Corpuscles, suppose of Marble, Flint, Coal, and other more uniform Substances, should in that precipitous hurry of Gravitation meet and unite again, in Marble, Flint, and Coal; and that sometimes too in Laiers beneath heavier, and sometimes above lighter Substances than themselves, against the order of Gravity. And 'tis no less difficult to apprehend how it came to pass, that in this confused hurry and agitation, the heaviest Corpuscles had not seated themselves at, and closed about, the Center of Gravity; there

there being no sufficient reason yet given, why solid Particles heavier than their quantity of Fluid wherein they move, should not descend in that Fluid as far as the Fluid can give them way, to their proper Center; and therefore the whole Frame and Texture of the Earth being so dissolved, as the Hypothesis supposes; and every Particle of it playing in a space of Water, and that Water being Specifically the same from the Center to the Circumference; what would hinder the heaviest parts of Earth to fall to, and close about that Center; and the next in gravity to succeed, and so one Sediment after another, till all had settled, leaving out and protruding the Mass of Water, all above the united Central Solid, except what might remain in little Hollows and Interstices, which would appear an easie and a Natural effect of such a Procedure? But why the Corpuscles D, directly descending and moving towards the Center A, should stop at B, forming a Spherical Concave about the Center A, I must profess I cannot conceive; for their crowding close together, could not keep up the lowest Particles still from falling. Yet the Doctor must have

a central Fluid : If he answers, that the parts of the same specifical Body of Water are proportionably heavier, the nearer they are to Center ; so likewise must the Earthy Particles at B, be heavier than at C ; and so the Water of the central Concave can have no greater power of resistance against the Earthy descending parts at B, than the same Water had at D, or C, tho' much remoter from the center, they increasing or decreasing alike in gravity ; (for both Opinions are held ; and in this case 'tis no Matter which ;) as they make Proportionable approaches to the Central Point. That of Dr. *Burnet's* Oleaginous Surface of the Water, or Mr *Whiston's* dense Fluids, can be of no service here ; for an oily Surface cannot be near the Center ; and dense Fluids remove the State of the Question ; they (if there be such a thing) are of quite different Species from the Fluid we are speaking of.

Fifthly, Supposing that there might be a Mass of Fluids spherically raised to that Altitude as was capable to give the Terrestrial dissever'd Corpuscles a Scope to pursue the Laws of Gravitation, and in the manner the Doctor propounds,

pounds, to form the Shell and Cortex of this Earthly Globe ; we are left yet in the dark, as to the Main, and indeed what should have been the foundation of his Hypothesis ; that is, in being assured, or at least, in having it intimated to us, what determin'd Power, Force, or Quality, inherent or for that time acquired, it was in that *Diluvian* Water, which might and could effect that dissolution and disjunction and separation of the most intimously conjoined consolidated parts of the most hard impervious Substances, and could so dissolve, dilacerate, and take them so asunder, as to volutate and raise the minute Corpuscles thereof, and put them into that posture, that they might statically subside, and by so subsiding form the Involution and *Strata* of this present Terrestrial Globe.

All powers of Matter (we know) are derived from their Essence ; and 'tis the essential property of all Bodies to work by Contact, or immediate Application of their Parts: Now 'tis evident that the Parts of this Fluid could not operate where they could not come ; and how Water could penetrate the most com-

pacted solid Substances, and insinuate
 and interpose itself betwixt their most
 closely conjoined and subtile Particles,
 is too difficult to imagine : And tho'
 the parts of this Fluid might, and pro-
 bably did. penetrate and dissolve the
 loose and pervious Earth into a great
 depth, yet it seems impossible, upon
 Natural Grounds, it should pervade
 and come into the inmost and closest
 Recesses of Chalk, Marble, or Porphy-
 ry, and other most hard and petrified
 Concretions, of which the Earth most-
 ly consists ; and if that Fluid could not
 enter into, and pervade the Pores and
 Interstices of these consolidated Sub-
 stances, it is evident it could not at all
 dissolve and unchain their Links, and
 utterly demolish their Consistence and
 Solidity, so as that all Cohæsion perfectly
 ceased ; and if it did so in some, why
 not in all concretions ? And then what
 will become of the Doctor's *Ante-dilu-
 vian* shells, and of his Opinion concern-
 ing them ? His place of *Genesis*, that
 God destroy'd the Earth, he has very
 deeply expounded ; for surely if *Moses*
 had been of this Gentleman's Mind, in
 expressing that particular, he would
 not have told us, almost in the next
 words,

words, that the Earth in that sense was not destroy'd, but that the Waters prevailed exceedingly upon it, the highest Mountains lying Fifteen Cubits under them ; which if there were no more, abundantly proves the contrary to the Doctor's Supposition ; What natural reason can be given of Rocks and Stones being then dissolved under those prevailing Waters, which continued over them but one Year, when we find that no such Dissolution is effected on them in the bottom of the Ocean, where they have continued soaking, not one, but some thousands of Years?

More might be said ; but upon a general view of the Principles this ingenious Person has unhappily espoused, to maintain his Conclusion ; the Letter from *Oxford* charges him with more particular deviations from *Hydrostatick* and *Geometrick* Truths : But however he came to fall on that fallacious way of arguing, no necessity from Similitude of things (which he seems to plead) can warrant it ; he is certainly Master of great Knowledge and insight in the Nature and diversity of Subterranean Rarities ; and a Structure ill founded

founded, may be built a new, without discredit to the Builder; and without doubt his vast Collection, which they say he has from all Regions and Climates, of what is rare and observable, may enable him to do much that way, on better and more warrantable Principles.

What is, or may be, affirm'd by others in favour of this Opinion, I cannot yet say: I know nothing in Dr. *Burnet's* Model that can be serviceable to it; the rude Chaos, as in the gross heap, so in all the parts of it, being too confused, ghastly and ill-favour'd, to give a Pre-existence to these prettily form'd and regular Fossils. Neither will Mr. *Whiston's* Theory, who very warily passes by these *Phenomena*, be any help to solve this point; both Dr. *Burnet* and he giving us such a description of the Original Chaotick Separations, as will not afford the least Countenance to this Opinion; which would have all these Fossilfigured Concretions, Shells, Teeth, Bones, &c. to have a pre-existent being, before their Lodgment in those dense compacted Substances, viz. Chalk, Rocks, Stones, &c. where they are now found and discover'd. And if any
 imagine,

imagine, that, according to Mr. *Whiston* the
 Creation-days were annual Revolutions,
 the diurnal Rotation of the Earth about
 its own Axis having not begun till
 the Fall of Man, as that Author con-
 ceiveth ; and that consequently a time
 and space of two years might well suf-
 fice for the Formation of these Bodies ;
 he must yet remember, that tho' the
 separation of Earth and Water happen-
 ed the third day (or year in Mr. *Whis-*
ton's Account,) yet be the determin'd
 time and space of those days what it
 will, the *Mosaick* account is exprefs,
 that the Production of Marine Animals
 was after that separation ; that is, on
 the fifth Day, or Year ; as the division
 of Sea and Land was on the third ; And
 if no such things as Shells and Bones of
 perfect Fishes existed before the Fifth
 day of the Creation, as 'tis plain they
 did not, the Earth having been sepe-
 rated from the Sea some two days before ;
 it is hence apparent, that the Sea or
 universal Fluid, could not, at that time
 leave such things in and upon the
 Earth, such things being not at that
 time produced into actual perfection,
 capable of leaving such remains behind
 them.

If

If Mr. *Whiston's* ingenious Fancy may carry him yet further, to suggest, that as this present Globe at first grew out of the Ruines of an ancient Planet dissolved to the consistence of a Comet, and was after that increased at the Deluge from the *Atmosphere* of another, and that consequently these Fossils might one way or 'tother, owe their Original either to the pre-existent or pertransient Comet; then what will follow? Even this; If the first be true, then these Shells, Spines, Bones, &c. are the parts of Creatures that existed, Gods knows where, before the time of the *Mosaick* Creation: If the second be granted, then it will follow, that there are some parts of this Globe, now existing, that were not then created; if the *Mosaick* account, as Mr. *Whiston* would have it, be restrain'd to this Elementary Terrestrial Globe; both which are equally absurd and extravagant.

Thus we see, let them turn on which side they will, they will find it an insuperable Task to give an intelligible account how the *Exuvie* of Marine Animals that have been once perfectly such, could possibly come to be universally dispersed in and among the several

several *Strata* of the Terrestrial Crust : and yet there embodied even in the hardest of those *Strata*, we find vast plenty of such Shells, so exactly and perfectly corresponding in shape, colour, texture and disposition of parts, with the natural ones bred in the Sea, and found on our Shoars ; that if meer resemblance would be sufficient evidence, it would be argument enough to induce any one to conclude them to be really such : And did the Patrons of that Opinion but once demonstratively assign a *Possible* way upon natural and intelligible grounds, of the Conveyance of these *Exuvie* to the places wherein they are now found, without receding too much from the truth of Nature, as well as of Scripture ; most Men, I think, would be sway'd by the force of that Argument to take them to be true, real, and Natural Shells, Teeth, Bones, &c, of Fishes, once bred and nourished in the Bosom, Creeks and Angles of the great Surrounding Ocean. But we too well know that Similary Appearances too often sham and banter our Reason, and impose upon our Faculties ; Nature not seldom proceeding by the same means, to very different ends and In-

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tentions ; and for us to determin, from the Identity of her ways and measures, the Identity of her Intentions, in different Subjects, would be very false and groundless reasoning. And tho' it be inconsistent with the Wisdom of Nature, or indeed of God the Author and Guider of her, to work any thing to no end or purpose ; which makes that saying universally true, *Natura nihil facit frustra* ; yet to conclude this or that, to be to no end or purpose, because we cannot assign one ; for instance, to say, that Teeth without a Jaw, Bones without Flesh or Fish, or Shells without an Animal Inhabitant (which I find to be one of the chief Arguments of *Fabius Columna*) is contrary to the designs and intentions of Nature, when her bounds and limits that way (many of them) are unto us unknown and uncertain ; is to deal too boldly and unfaithfully with her ; And Arguments drawn from that Head, how Specious soever they may be, smell of too much arrogance in us, to be well relished and entertain'd. Nay indeed, the force of that Reason (if duly weigh'd and attended to) will appear to incline wholly on the other side ; It doth not so much conclude,

conclude, that these Fossil Shells, Bones, &c, had been once really and actually Parts of Animals, *because* it may appear to be against the intention of Nature, that Teeth should be found without a Jaw, or Shells without living Inhabitants; as it doth prove, that if there do appear really and *de facto*, Shells and Bones without such Concomitants, or without any possibility of ever actually having them, that *therefore* there are such things in Nature, that are really and actually Shells and Bones, though it may possibly be as much removed from the reach of our Knowledge, to determin, by what means, as to what ends and purposes they were so produced and specified.

And truly in this regard I can see no reason why those people that daily observe the many and some very exact resemblances in the parts of Vegetables, to the parts and members of Animal Bodies; of which there are Multitudes of instances in *Oswaldus Crolius* his Tract of Signatures; can yet by no means prevail with their Faculties to believe that there might be the like Analogies and Similitudes in the parts of Stones and Minerals.

rals, with the said parts of Animal Bodies, without making them to be the true and genuine parts of some of those Bodies they resemble.

Why may not Nature in her first Strokes of Congelation pursue the same Paths and draw the same Lines, both in the Formation of some parts of Clay, Stones and Marchasfites, and in the framing of Oyfter-shells, Cockles, and Perwinckles, &c. as well as she is observed to delineate very like Strokes in the head of Poppies, with those in the Skull of Man ; in the Jews-ear, the Leaves of Colt-foot, with the Ear ; in the Seed of *Aconitum*, the Flower of Eye-bright, with the Eye ; in the Husks of the Seed of Henbane, and Pine-kernels, with the Jaws and Teeth ; in the Fruit of the Citron tree, with the Heart ; in the true *Scolopendrum*, *Asplenium*, and *Cetrach*, with the Spleen of Man. Some of these do with great accuracy resemble some parts of our Body, and perhaps with greater than some Shell-stones do their respective Prototypes.

There are some Figures which are the pure effects of Mechanism, and not at all the ultimate designs of Nature ;

ture ; and these general Forms and Models of Nature, being as it were her common road, she may be observed to *trace* them to several Ends, to *pursue* the same Tracts to various Purposes and Intentions : Thus we find in the growth of Fearn, in the *Ramusculi* of Snow and Hore-frost, and in the freezing of Urine, Nature affects one and the same way to protract her Motions : Not that there doth lie any particular design upon the Figure, but because it is the most *Concise* and *Expeditious* way of dilating : And if it seems consonant with the usual Processes of Nature, on account of *Brevity* and *Conciseness*, to choose one and the same way to exert her first strokes of Motion in several Subjects, tho' tending to different ends and purposes ; 'tis no way fair to conclude ultimate and particular Intentions, from the meer position of any one of her general rules and ways of proceeding.

Now that *Conciseness* and *Brevity* may be a sufficient assignable cause of the unity of her Plastick Motions in her various Structures and Efformations, will appear not only from the ordinary Proplepsis we have of the Sagacity and Wisdom of Nature, perceivable in her most
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trite and common Operations; it being the Property of *that*, ever to make the shortest dispatches; but also, which we ought principally to take notice of, from a Necessary and Mechanical *Constrainment* which the first strokes and delineations of matter lie under, to form themselves with such Angles, degrees of Extention, proportion of Parts, and other Respects and Habitues one to another, as most conveniently suit with, and answer the Scope and End of their Dilatation.

This Geometrical Disposition and necessary Mechanism of the first strokes of Nature on account of *Dispatch* and *Brevity*, is observable almost in all constant specifical Productions; of which I shall briefly touch on a few instances.

1st, All Vegetables of a tall and spreading growth seem to have a natural tendency to a Hemispherical Dilatation, but generally confine their spreading within an Angle of 90 degrees, or an exact Quadrant, as being the most becoming and useful disposition of its Parts and Branches.

Now the shortest way to give a most graceful and useful filling to that space of dilating and spreading out, is to proceed

ceed in strait Lines, and to dispose of those Lines in a variety of Parallels through the whole Extension ; and to do that in a Hemispherical or Quadrantal Space, there appears to be but one way possible ; and that is, to form all the Intersections which the Shoots and Branches make, with Angles of 45 degrees only ; and I dare appeal to the observation of Mankind, if it be not in this manner almost to a nicety *observed* by Nature in the *first* and *primary* Directions of all Vegetable Shoots ; though yet when these Shoots are grown and spread out , external Impressions may, and always do, occasion Curvities and Reflexions ; that is, That they have the main Stem, Branches, Lateral, Collateral, Sub-collateral, Latero-sub-collateral (or into as many Divisions as Nature usually reaches to, above a Horizontal Plane) of, or very near approaching to an Angle of 45 ; which in a Hemispherical or Quadrantal Space, makes all the Shoots and Directions of Branches run out into Parallels of three sorts only, *viz.* Perpendicular, Incident and Horizontal ; as appears by the Figure.

The

The Lateral Branches being all Incidents, the Collateral a Composition of Perpendiculars and Horizontals, the Sub-collateral as the Lateral, and the Latero-sub-collateral as the Collateral, and the distance and interjacent Spaces being all a sort of Rhomboids; all these, being Affections of that Angle and Section; I ask if it be any other way possible for Art or any intelligent Principle to fill up this described Space more compendiously and commodiously, than we find the natural *direction* of these Vegetable Shoots and Branches inclined to perform; and what I demonstrate of the Superiour or *Supra*-Horizontal Space, the same is applicable to the inferiour or radical Dilatation; though the unmanageable Stiffness of the Ground disturbs the natural direction of those radical Shoots, as the violence of the Air, ponderosity and other Accidents, do that of the upper Branches. I do not say that all Trees do grow up thus; but the greatest part of them shew that Nature generally affects that Angle, on which the other Properties are depending.

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Therefore from this Speculation we may conclude, that (the shortest Procedure being allowed in streight Lines, and the Production of these Lines in these three sorts of Parallels being most prompt and facile, and all that depending on one Angle only) Nature being allowed to be a Provident Agent, lies under a sort of Geometrical necessity to dispose her Emanations just thus, and no otherwise, in the expedition of her Plantal Ramifications: And it being so; that all Spreadings from a Point or Center, as all Seminal Productions are, affect a Sphere either entire or divided, for their Activity to display in; It is therefore highly reasonable, those Activities should betake themselves in one and the same way in variety of Subjects; and we may thence as reasonably conclude, that the close invariable pursuing of that way, is nothing in the World else but the effect of Mechanism, and Geometrical Necessity; a visible Argument, that the Plastic Capacities of Matter are governed and disposed by an All-wise and Infinite Agent, the native Strictnesses and Regularities of them plainly shewing from whose Hand they come.

The same Geometrical Process and Order, is observable also in the first Strokes of Nature in other Instances, particularly in what is the Subject of this Writing; *viz.* the Formation of Shells. In these she generally occupies a greater Latitude of Dilatation than a Quadrantal Space, which in Vegetables she seems to content her self with : And as the parts of Matter she imployes in the Formation of Shells, are more stubborn, untractable and rigid, than the Vegetative Ingredients; so she is oblig'd, and under a necessity, to draw closer Lines, and to make sharper Angles betwixt her first Shoots and the *Radii*; and consequently to make more obtuse ones in the transverse Lines and Peripheries, or the tacking together of the main Strokes, with cross and collateral Lines; than what I have observed in Trees and Vegetables; which is also a necessary result of Mechanism.

For when a Gradual Enlargement and Dilatation proceeds from one Point or * Center, as the same is manifestly apparent in almost all perfect Shells;

*I reckon in
all Seminal
Producti-
on the Seed*

or Sperm to be their Root or Center, from which their Lines of Augmentation are drawn, and thence directed to their several Ends and Specifications.

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the most *Concise* and regular way, and most agreeable with the Reason of our Faculties, always practised by Art, performed by natural Instincts, as may be observed in Cobwebs and Spider-works, is to protract streight Lines or *Radii*, with equal Distances and Angles, from the Center to the designed Peripherie, and the determin'd Figure of the Peripherie to be according to the different lengths and terminations of those *Radii*; which is seen to be performed with great accuracy and exactness, in bivalved striated Shells, especially Cockles and Scallop Shells, both which sort of Shells affect a sort of Semicircular Dilatation, and differ only in bigness, and in the flatness and gibbosity of their Valves.

So also in Oyster-shells and Muscles, which seem to have another make, Nature proceeds in their Formation just as the most skilful Artist would do, if he had the same Materials for his purpose, and the same Design and End to aim at; that is, in extending and shooting out a multiplicity of their *Ramellæ*, each one larger than another, and plated one upon another, from the Root or Center to the Peripherie or Circumference, as may be discovered by

the rotting of these Shells in the Earth, or by dissolving them in Vinegar or any other *Menstruum*. These smooth and laminated Shells seem to be more loosely and weakly built than striated Shells, because they are naturally fix'd to a place, by a Root or Tendon, and are not exposed to the Volutation of the Sea, which would require more strength and firmness, as is observed to be in the more lasting striated Shells.

Thus we may Geometrically conclude, that all Plastick Dilatations proceeding from one Point or Center, have on account of *Conciseness* or *Expedition*, a natural Tendency to a sort of Spherical Figure, either whole or in part; and near which, abating the Distortions of Gibbosities, and Contractions of Brims and Edges, all Shells usually arrive; Nature being under as great a Necessity of forming these Figures, either quarter, half, or full Rounds, or near approaching them, as any Artificer is of making round Wheels to perform the Motion of Machines and Movements. But in the Formation of Shells, this is yet further to be considered, that they are naturally and originally designed to be the containing Teguments and Defences

fences of contained Animations ; and on that account, the End being the chief Regulator in all Structures, in the growth and augmentation of these Shells, their Plastick Matter issuing and streaming out of one Center or Spermatick Point to build the Frame and Texture of a Shell or hollow Cottage for the Fish to secure it self and inhabit, it is Mechanically necessary that all Shells naturally tending to a Spherical Dilatation, their Plastick Matter flowing equally round their Spermatick Point or Center, should be either Bivalves ; that is, two Compress'd or Contracted Hemispheres, their Segments or Openings intersecting their divided Pole or Center ; or one round hollow Cone, as all turbinous and Ophiomorphous Shells, abating their Folds and Twistings, seem to be ; So likewise it is necessary that such shelly Dilatations as do not flow circularly, but occupy only one part or space of a Circle, should grow triangular, and so have their Central Angle folded in with as many turnings as its length will bear ; and in that folding have the Sides and Arch a little bent and contracted for a convenient Cavity for the Fish to dwell in ;
and

and such we find it exactly to be, in that Species of Shells which are of that sort of shape and extension.

In every one of these general Formations, as the Figure of the dilated Mass, Circular, Semicircular or Triangular, (for on a Circle and its central Sections, I observe the Figure of all Shells to depend) is a necessary result of Mechanism; so the forming out of these, Cones and Bivalves, and Triangular Involutions, which comprehend the Figure of all perfect Shells, is the quickest, most expedite, and easiest way that the Wit of Man could invent, if it had been left unto it to fold and lap up, and shelter those tender Creatures; So we find that the general Figure of Shells seems much to depend on a Circle and its two central Sections; and as to the manner how they are formed out of them, we may conceive, that as the Generation of all Shells, of the perfect kind, proceeds from a Point or Center, which is the Sperm or Seed, so the protraction out of these, of the Lines of Augmentation, if their Root or Center be undivided and of equal strength and efficacy on all sides, must be spun out, and grow into a hollow Cone or Conoid,
and

and so form, if the power of Protraction join Ends, the *Patellæ* or broad-coned Shells. But if the power of Protraction be more exertive and vigorous, then it draws out the Cones to a length, wreathing and twisting them into Perwinckles, Turbens, Spindles, and other Cochlear turbinated Shells; and if it has not a free *Medium* to display that spiral Elevation, then it compresses and folds them, in a Plane, into *Nautili*, *Cornua Ammonis*, and other Serpentine Figures.

Next, if the said power of Protraction be divided at the Root or Center, and be equally strong and vigorous on each side, then the Dilatation becomes bivalved, and makes two irregular Hemispheres, as their Lines or *Striæ* calculated together plainly demonstrate, extending, streightning, or compressing their Peripheries, as the length and contraction of their Lines, and Gibbosity of their Valves, exact and determine; forming such Shells into Cockles, Escallops, Oysters, Muscles, and all other Specificks of bipartite Shells.

And lastly, If this power of Protraction be severed and divided at the Root or Center, into more Parts than two,

two, then these divided Parts or Branches, by such a Section, as I said before, must become Triangular; and consequently those triangular Dilatations, being not join'd together as Valves of one Shell, must (to form a Cell for the Fish to dwell in) fold in their Central Angle, turning in also a little of the Arch or Subtense of that Angle, and so form the *Concha Veneris* and such Species of Shells as seem to be made up of involved triangular Dilatations.

Now from all this I propose it may be considered, that if some Figures be the necessary result of pure Mechanism, and if the primary Exortions of Nature do necessarily and mechanically fall into those Figures; and lastly, if the more general Forms of Plantal and Testaceous Dilatations be those necessary Figures; why should we stand amazed and wonder, that in the Original Congelation of Bodies, there being then an Infinity of such Exortions, some parts of Matter should run into these Forms and Figures, which they were as necessarily drawn and moulded into on account of Mechanism, as any growing Shell or Plant that Sea or Land can afford us? Nay, this thing being well adverted
unto

unto it, should rather draw our wonder on the other side ; that is, that we find so few of these Figured Concretions in congealed Substances ; no Plantal Delineations, save a few now and then, in Coal and Slate-stones ; and not very many shelly Impressions, but in such places where a Calcatious Matter, of which Shells consist, predominates and abounds.

But although this way of proceeding may very well account for many *Phænomena* in the Theory of Shells and other Fossil Rareties, in a general view of similiary Forms and Appearances ; yet I must confess it does not reach to solve the most considerable Difficulties, that Theory is encumber'd with. *viz.* Particularly, though general Figures may be the effects of Mechanism ; yet it may, and ought to be, reasonably demanded, how the specifical Determinations of those Figures, how the Contraction and Curvitudes and Angles of the direct and transverse Lines and *Striæ*, and other Specifications of Fossil-shells, the Insertions of their Valves, their Diaphragms, and the Symmetry and Order, and the gradual Disposition of all the parts of them, came exactly to
H be

be of the same Make, Contexture and Dimensions, with those Marine ones, of their respective Kinds, which manifestly proceed from a Seed or Sperm: How also those Plantal Delineations, in Coal and Slate-stones, should circumscribe their Foliations, and terminate their Lines, to the exact Figures of several sorts of Fearn, and especially into the Proprieties of Harts-tongue, Cinque-foil, Clover-grass, Strawberry Leaves, which are uncontestedly Seminal Products, as I hear they are observed to do; to perform all this, is plainly above the Mathematicks of Nature; and since it is done, it becomes an Objection that will supercede and raise our inquiries from these mean and lufory Effects of Mechanism, to the Contemplation of a higher and more powerful organizing Principle, capable of guiding and specificating the Motions of Augmentation unto all those determined Figures, in order to give it a compleat and satisfactory Solution. And this Principle, however it be conceived to be in a way to produce these Effects, can be no other than a power-Seed or Sperm: And if there be not a possibility in Nature, of finding out

a way by which this efficient might be the cause of these Effects ; I think we may cease our Inquiries about it, and let it rest for ever in the most recondite Cabinet of Natures un-revealed Secrets. But if it appears possible, or any way probable, that these surprizing Effects may be the Products of Seminal Parents, as their like are in other Circumstances, I hope the Patrons of the first Opinion will appease their Scruples, and the Solution of the greatest difficulty in that Theory (the said possibility being once demonstrated) will become very natural, intelligible and easie.

In order to which, having from what evidence we have of the true State and Constitution of Things, conceived some Grounds for such a possibility ; I think it not unacceptable, to lay out some poor Endeavours, to elucidate a point of that concernment to the Curious ; in which yet I shall no farther attempt, than to offer a few problematical Conclusions, which if they be solidly evinced and demonstrated, as much as the Nature of the thing will bear, will, I presume, infer a possibility at least, if not some degree

of probability, that these *Osseous* and *Testaceous* remains taken out of the Earth, are the Products of, and owe their Formation and Existence to what we call Seeds or Spermatical Energies : To which Conclusions I shall a little strew the way with these *Præliminary Postulata* or Propositions ; which being well grounded and established, the Consequences I shall draw from them will be the more firm and immoveable. And therefore,

My *first* Proposition is, that the Sphere of Matter consists of Space and Body, and consequently of parts really divisible, to a vast degree of Minuteness.

Secondly, That the just Magnitude of any of the Aggregates or united Portions of these Parts (as to us) is utterly unassignable ; and what we may determine of their *quantum*, is only Mathematical and Comparative, with relation of one Aggregate to another.

Thirdly, That there are certain Portions of this Matter, of extraordinary Fineness and Activity, called Seed or Sperm, indued with a Power of unfolding and augmenting themselves unto determined Shapes and Measures of Extension.

Fourthly,

Fourthly, That Generation, Growth and Corruption, are but the Rise, Progress and Rest, the Explication, Motion and Pause, of these Seminal Powers and Activities.

Fifthly, That these Seeds or Spermatical Portions of Matter, contain within them, entirely and individually, the Body or Bodies they produce, and all the parts of those Bodies, as Sinews, Muscles, Bones, Shells, and the like, and as it were the Seeds too and component Particles of those Parts, in immeasurably small and unperceivable Proportions.

Sixthly, That these Seminal Collections of prolifick Matter, were at first prepared, modified and produc'd into Being, in the Primi-genial Chaotick Fluid, *Venus orta mari*, and still require a watry Vehicle to unfold and propagate.

Seventhly, That all the now solid Parts of concreted Matter, or at least, a great and vast deal of them have been originally a fluid Mass, or substance highly agitated; and from that State, by several degrees of Lentors and Arrestments of Motion, they thickened and coagulated into various sorts
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and qualities of Fluors; and thence after some Separations, congealed and hardned into this present Terrestrial Crust, consisting of Clays, Stones, Marchasits, Minerals, Metals and common Earth.

These short and previous Hints, which I lay down as the Grounds and Evidence of my Conclusion, are in themselves very Natural and Intelligible; and as such, have been all of them propounded, asserted, and vigorously maintain'd by very many learned Men, both Ancient and Modern.

The first Proposition has been asserted by many Ancient Philosophers, *Pythagoras*, *Democritus*, *Leucippus*, and even by *Plato* himself: Neither doth *Des Cartes* of late, who seems most of any to impugn it, at all invalidate what I propound, by my calling it, not *vacuum & plenum*, as the Ancients did, but Space and Body, which he very well allows of, provided they equally fall within his Notion of Extension.

The second is demonstrated by *Euclid*, and generally asserted by all Micrographers and Geometricians.

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The third and fourth are visible Demonstrations, and plain Objects of Sense.

The fifth is with great probability and demonstrative Strength of Reason maintain'd by Father *Malebranch*, *Luen-hooke*, and confirm'd by the attesting Experiments of Mr. *Boyle*, and Dr. *Hooke*, and assented unto by Philosophers of principal Note and Estimation.

The sixth was the Ancient Hypothesis of *Anaxagoras*, *Hippocrates*, and is the approved Sentiment of the best Physiologers and Chymists; that every Seminal Propagation is *ex humido*; and consequently the Analogy will make the Maxim universally true, that *ex aqua crescentia profluunt*.

The seventh Proposition, is indeed a main part of *Des Cartes* his Philosophy; and will, if thoroughly contemplated, both explain the Powers of Gravity, and account for all its Effects of Gravitation and Sedimenting, as well perhaps as any of the now much-talked of Modern Explications, otherwise conceived and worded.

These being established Theorems, by most Men assented unto, and by
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very few deny'd; I hope what Corollaries will necessarily and naturally flow from them, will be, if duly explicated, of prevailing weight to infer, at least a possibility of the designed Conclusion.

First, I offer from the first Proposition, that it is possible, there may be exact Mechanisms and Fabricks of most exquisite Contrivances and Dispositions of Parts, contain'd in the very least (as to us) and utmost conceivable Minuteness of place; there being in that *punctillo*, a Body to extend, and a Space to be extended in; and as a consequent of that, [from the second Proposition] that by much the greatest part of Animal Specieses and individuals, are undiscovered by us, being as to us so extremely small, that without the help of Glasses, not one of a Million can be seen and distinguished: And Mr. *Leuwenhooke* assures us, that by these helps, he has discovered some Animals which were so exceeding small, that, saith he, if a Grain of Sand were broken into 8000000 of equal parts, one of these would scarce be exceeded in bigness by one of these Creatures: And Dr. *Hooke* goes yet farther, who says, that he had discovered some Animalculs
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so excessive small, that Millions of Millions of them might be contained in one drop of Water : And therefore if there might be actually so many Millions of these altogether compleat and perfect Creatures, existing in a drop of Water ; what an unconceivable infinity of them, in their Seeds and contracted Parvitudes, might in the beginning exist in the whole Mass of Waters ?

Secondly, I offer from the third, fourth and fifth Propositions, that if all animated Creatures do exist in their Seeds, though in a contracted State, and in vastly lesser Dimensions, yet *Completely and Perfectly* ; that is, as compleat and perfect Beings, as they would be in their utmost Specifick Magnitudes and Extensions : It is therefore very agreeable with the order of Nature and Divine Wisdom, that the first Creation, or primary Production of these Beings (Man's excepted) should be in their Seeds and contracted Parvitudes ; they lying there as compleat and perfect, as in their utmost Bulks and Explications of Extension.

Now it being supposed that the primordial State of animated Beings

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(Man's excepted) was in their Seed or Sperm; it is easily conceivable, that these primary Seeds, Ovaries, or epitomiz'd Animations, and contracted Abstracts of Things, being in that State absolutely and compleatly perfect, and on that account in an agreeable Condition to come from the Hands of God; 'tis, I say, conceivable, that as many of them as met with a fit Medium and proper Matrices and places of Explication, were then and there, in a natural way, by assumption of peculiar Particles of Matter, that were more or less abounding in such places, to explicate and enlarge themselves to their determin'd specifick Bulks; and yet in those Extensions, to carry with them, their Ideas and Miniatures *in parvo*, to continue their successive Explications and Enlargements, from that time properly called Generation, to the World's end: Which latter I call the Seeds of Generation, as the former may very properly be called Seeds of Production.

Thirdly, I offer from the sixth Proposition, that these Seeds or spermatical Activities, contracted, formed and qualified, as in the foregoing Propositions; when first created and produced into beings,

ings, in and for some space of time lay dispersed and floating through the whole Mass of the first Universal watry Fluid ; which being the first Matrix or Principle of Corporification, if I may use that Word, and the only capable one in Nature, of yielding Room and Materials for growth and Augmentation, was on that account the fittest Repository to lay up those Eggs of things ; and by and with the convenient Instrumentality of it, to brood and hatch, and to dispose and distribute them to their peculiar Elements and Places of Fætation, in order to set on, maintain and conserve their successive Generations to the World's end.

Fourthly, I offer from the seventh Proposition, that when this Universal Chaotick Fluid, the first Conservatory of these Corporeal *Activities*, underwent further Separations ; a great deal of it came to obtain greater and greater Degrees of Coagulating, and to be condensed into still more gross and thicker Fluors, or a sort of soft ouzie Consistency ; I say, in this coagulating Recession or Precipitation of the Chaotick Fluid, those Kinds of Sperm floating in it, which were Productive of Ae-

real Animations to cover and inhabit the Face of the Earth, had more of Air and Life in their Composition, and were consequently lighter, and therefore statically ascended and kept up in the higher and purer Regions of this thickening Mass; until upon appearing of the dry Land, they came to be left in plentiful Proportions on the Surface of it; there to produce Plants, Animals and other Furniture of that fruitful Element; *Let the Earth bring forth the Living Creatures after their kind*, Gen. i. 24.

But the other kinds of Sperm, the Seminary of the Ocean, the Squammose, the Crustaceous, and especially the Testaceous Kinds, being more gross and heavy than the former, and of greater Agreeableness and Congeniality with the watry Consistence, descended with, and stuck in it; and when that thickening Fluid grew yet more coagulated and condensed, vast Proportions of those grosser Sperms might come to be impacted and incorporated in its thickest Sediments and condensed Fluors, and so came to be closed up in the congealing Masses, which then formed and constituted the *Strata* and *Involutions*

volutions of this Terrestrial Globe.

In this state of things we are also to conceive that when the various sorts of these Sediments once settled, and when the *detruded* Juices and condensed gravitating Fluors, the most defæcat and purest of them, such as became the component matter of Clays, Stones, Minerals, &c, commenc'd the Act of Congelation, and began to consolidate and petrify, it is apparent from the third Proposition, that these Sperms and Seminal Activities, where-ever they were, first of all began to put out and exert their strokes of Dilatation; in which act of Congeling and Consolidating, the Matter of those Fluors in which the said Seeds or Sperms were included, coming by degrees to a stony Hardness; we must imagine then, that these vigorous Activities, while yet the Matter wherein they were lodged was raw, soft and fleeting, so far acted and put forth their peculiar Energies and Powers, in displaying and expanding themselves; as the parts of that Matter, which they were invested with, could fit and supply them with proper and agreeable Materials: Which could be no more, than in the *Testaceous* Kinds
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to build up the Fabrick of their Shells ; which they might perform there compleatly and exactly ; that lapidifick Matter being the proper Aliment of that part of the Sperm, that lay within the Mineral Province, and was to shoot out into Shells and Teguments ; And also the other fishy part of the Sperm, being there out of the Animal Kingdom, failing for want of due Matter and Aliment to work upon, the contained Intervals and Spaces of those shelly Concretions, which the Muscular fishy Exertions of the Sperm were to occupy ; for want, I say, of that due Matter, to give it Increase and Animal Production, those Intervals came to be filled up, instead of Fish, with the common Matter of those petrifying Juices, which they were included in, or with the purest and most lubrick parts of Matter, as Spar, Flint, &c. that ran in, and filled their Cavities.

But in the *Squammose* and *Cartilaginous* Kinds of these Sperms, detain'd as before-said in these detrued coagulating Juices, their plastick Exertions had much less of these fit Materials to act upon ; yet we may well suppose that their quick and more vigorous Activities

Activities might there also in the same manner begin to display their vital Shoots and Formation; and where they chanc'd to meet, among those stiff unwealdy parts of Matter, with agreeable Materials, which must have been very rare and uncommon, they might hit here and there where they met with such, on the Formation at least of their hardest *Osseous* Substances, as Teeth, Spines, Ribbs, &c. and form those into Analogous Figures; At the same time the other parts of the integral *Compages* all failing, where the Portions of Matter to be acted upon were too coarse and untractable to be wrought and modified into an *Organical* Consistence. In short, such parts of these Animal Seeds as bordered upon the Mineral Kingdom, might very well be form'd into Shells and Bones, the rest for want of proper Matter all failing.

These Processes of Spermatical Exertions I reckon all along as primary Productions, or the Original Formation of things unto their specifick Magnitudes and Perfection; pursuant to that All-powerful Word, *viz. Let the Earth bring forth, let the Waters bring forth abundantly*; and not as Generation, which

which I reckon a secondary Production, influenc'd by that other efficacious Command, *viz. Increase and multiply*: And therefore, to conclude, agreeable with the Mosaick Accounts, with the order of Nature, and with the Mechanical Capacities of Matter; I affirm from the foregoing Propositions, that the Creation of these Seminal Powers, and Corporeal Vehicles of Life, was done on, or before the first Day of the Mosaick Creation, and is there symbolically express'd by Light and Darkness; and that from that time, these original Seeds of Things gradually one after another arrived unto their full Dimensions, Habitues and Perfections, in the space of six Days; in which time, especially the third and fourth Day, when the *Coagulum* of the Earth, newly separated from the Water, was very raw, soft and yeilding, and the hardest Rocks, and *Strata* of it, were yet in their Gellies: Then, I say, it is not unreasonable to conclude, that these mentioned Sperms, left included in the various Juices of the concreted Earth, might very well perform those Feats we now behold with

with wonder ; and which have exercised the Thoughts and busied the Inquiries of all Ages, especially of this wherein we live.

Now on the whole matter, having briefly premised, or rather hinted, what I conceive just necessary to conclude this Point; the Consideration before me falls in, and naturally determines in this Issue ; which yet I am very far from pretending to obtrude with any degree of certainty, but only to propound, as a probable Conclusion : *viz.* That all Fossil Shells, Bones, &c, digg'd up and found entomb'd in Slate, Stone, Chalk, Marble, &c ; all the Parts and Contents of them, however wreathed, marked, and striated, are on the one side so much the Productions of Nature, that they were originally formed and figured in those very places from whence they are taken up ; and yet are also on the other side so much the Remains of the parts of those Fishes they do imitate, that they are the Productions of the same univocal Sperms, which those parts of Animals they resemble, are derived from : In which Point methinks the two contesting Parties so nearly come together, that it is not to be despaired, but that if any under-
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takes to make a full prosecution of this Theory, and by many Discoveries and Experiments that are requisite to it, set things in their due Light ; there may be such a solid scientific Account handed out, as will sufficiently answer all the *Phænomena* that occur in this Speculation, and give therein a determining satisfaction to all rational Inquirers ; which is much desired by,

S I R,

Your humble Servant, &c.

P O S T.

POSTSCRIPT.

ALthough the Propositions laid down in this Letter, may justly and naturally import at least a Possibility of a Spermatick Origin of those Fossil Shells, Bones, and other Shell-like Impressions, often appearing in Stones, Rocks and Clay, in the manner I have accounted for ; yet if this Theory, and what I have attempted in it, takes in any thing contrary, or indeed dissonant to the *Mosaick* Accounts, in the just and natural, and now generally received sense and acceptation of them ; *ibit in ignes*, let it be dash'd out and expunged for ever.

But that it may appear to be far otherwise : that it may demonstrate the Grounds on which those Conclusions were built, which urg'd that Origin, to be in themselves very agreeable with the Sense and Letter of *Moses* ; and that the Discourse and Inferences made on that Subject may also appear innocent and able to stand on a warrantable Bot-

tom, I shall here sum up those Propositions, and place them in that Light and Evidence from the Texts of *Moses*, as they stand related one to another, that I hope upon an impartial View of the Parallels, there will be little or no scruple to be made, of the warrantableness of the Theory, in relation to Sacred Scriptures: Let the natural Grounds and Philosophy of it be their own Advocates.

The main Propositions of this Theory are chiefly reducible to these two, in reference to the Texts of *Moses*, on which they are grounded.

The First Proposition.

<i>And the Earth was without form, and void, and darkness was upon the Face of the Deep: and the Spirit of God moved upon the face of the Waters. And God said, Let the Waters</i>	The First Original Matter of this Elementary System or Earthly Planet, was an irregular formless Fluid, condensed and coagulated by gradual Separations and Digesti- <div style="text-align: right;"><i>under</i></div>
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under the Heaven be gathered together unto one place ; and let the Dry Land appear, Gen. 1. 2, 9. | ons into the Form of dry Earth, Air, and Water, surrounding and embracing each other in the manner we behold.

This Proposition is no other, in the true and natural Idea of it, than what *Moses* affirms ; What he calls on the one side *Deep and Waters*, is called here a *Fluid* ; and what he calls *gathering together*, is here term'd *Coagulation* and *Digestion* ; which being in effect no other than General and *Synonymous* Terms importing one and the same thing, may very well be connext together, and come under one Notion ; and what consequently results from the one, may therefore justly be entitled to the other.

The Second Proposition.

And the Spirit of God moved [hatched, brooded, Gen. 1.2. compared with Deut. 32. 11.] upon the Face of the Wa- | The Creation of all Species of Vegetables and Animals whether of Sea or Land, was in their Seed, or
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ters: And God said, let the Earth bring forth, let the Waters bring forth: and the Earth and the Waters brought forth abundantly, Gen. 1. 2, 11, 20, 24.

Contracted State and Parvitude; out of which the Earth and Waters when once settled, at God's Command brought them forth as from their Original Matrices, and gave them growth and Sustenance to arrive to their utmost Specific Bulks and Perfections.

The former part of this Proposition (I confess) at first view seems to have but little Countenance from the parallel Texts; yet the Word *Miracbephet* there, may admit of an Interpretation, which may afford some hints of the Original Make and Construction of these extraordinary Machines, the Seeds and Miniatures of Things, even in the unseparated and disordered State of the Primitive Deep or Chaos: But the latter part seems a more natural and easy Paraphrase of the parallel Texts; the Earth and Waters being only said to produce, or bring forth those Plants and

and Animals ; which by *Moses* his Phrase and way of Expression, plainly implies their actual existing, and having been created some space of time before the Production he mentions of them, at the third, fifth and six Days ; For if they had been then created, the Holy Pen-man had a Word at Hand (*Bara*, or even, *Gnascha*,) by which he expresses the Formation of the first Man, which might have compleatly signified their being then made or created : But since he expresses that act by other Words, *viz.* *Dascha*, *Scharatz*, *Jatza*, importing no more than Production, or indeed ordinary Generation, as will appear evidently by comparing those of *Gen.* 1. 11. with *Joel* 2. 22. of *Gen.* 1. 20. with *Exod.* 1. 7. and with *Psal.* 105. 30. and of *Gen.* 1. 24. with *Job* 1. 21. where the same Words plainly express no more than an ordinary Process of Seminal Births and Productions : It seems therefore conclusive to me, that these Words in the first of *Gen.* imply no more than such a Production ; and that those Products actually existed before the recorded time of that Production ; that is, among the then disordered parts of the Fluid Chaos.

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Now besides what may very reasonably be enforc'd from the propriety of these Words, to urge a Seminal Præ-existence *Præcedaneous* to the six Days Productions; the very order of Nature and the visible Scheme of Providence seem to intimate no less. For as it must be allowed that Providence superintends and governs Nature in all her Works, and is therefore on no contemptible Reasons called a continued Creation, because it supports the acts of Nature in their created Condition: I should from hence be very ready to conclude, that if this continued Creation, or the settled order of Providence deduces the Beginning, Rise and Progress of all animated Products from what we call Seeds or Spermatick Energies; that it is therefore highly reasonable, the same order being no other than the Will of God, and therefore constant and unchangeable, that the same Process, being but the Effect of that Order, should likewise deduce the first Commencement of Production from, and consequently prove the Creation or primary Constitution of, these vital Products, to be in what we call Seeds or Spermatical Bodies.

Bodies. And from hence it will be easy to conceive, that what the Mosaick History affirms of the Earth and Water's bringing forth the first set of Plants and Animals, means and should conclude no more, than that as many of these Seeds, as by the most wise order of Providence were in that Original Separation of Things distributed and convey'd to their proper Elements and peculiar places of Fatation, the All-powerful Word of God invigorated and quickened in those places, to put forth and display their specifick Growths and Capacities of Explication: And this being granted, I hope the conclusion I have advanced, of some of those Seeds sticking in, and being incorporated with the thicker Juices of the congealing Fluid, as was before accounted, may be allowed to be very possible, and not at all thwart the true Sense of the Mosaick Creation.

But to make this yet appear more plain and demonstrable, I shall sum up the Evidence of this last Proposition into this one Argument; that is, we must conceive, that either the Bodies of Plants and Animals were actually created at the time accounted by

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Moses, or they were created and actually existed some time before, and were then only produc'd to take on them the State of Growth and Augmentation ; That those Bodies were not then created, the very Words by which the sacred Author expresses the Procedure, are very strong presumptive Proofs : And indeed our best Expositors are not willing to allow of any Creation, properly so called, at that time : Now 'tis evident, that if they existed before, at least before the *Mosaick* Days of Production, they must be and exist amongst the rude and indigested Parts of the Chaos, the dry Earth ; that is, the dense coagulated Sediments of the *Mosaick* Deep, having not till the third Day appeared, *Gen.* 1. 9. And if they existed in the Chaotick Fluid, they must exist there either in their Seeds and Sperms, as the Proposition supposes, or in their Bulks of Maturity and Perfection ; in their mature State they could not, because the crude and undigested Masses of the Chaos were of themselves an unfit and unsuitable Medium to sustain and cherish them in that state and condition ; therefore the Conclusion is fair and demonstrative, that the
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first created Bodies of all Vegetables and Animals (Man only excepted) primarily existed and floated in that Original Fluid, in their Seeds and contracted Miniatures ; out of which the Holy Penman expressly affirms, that they were on the third, fifth and sixth Days produced and brought forth, and that too in the afterwards ordinary way of Nutrition and Augmentation : Nay, as to one kind of these, he speaks expressly to my purpose, namely Plants and Herbs ; *And God made, saith he, every Plant and Herb, before it was in the Earth, and before it grew, Gen. 2. 4, 5.* that is, as was before demonstrated, in the *Mosaick* Deep or Chaos ; and if there, then in their Seeds and Miniatures.

To this I add, that it must be confessed, that the Formation of all Seeds, of Vegetables and Animals, was the immediate Workmanship of God himself ; because 'tis plain, if no Fermentations, no Laws of Motion, no Mechanical Powers of Matter, as Mr. *Whiston* very well observes, can of themselves reach to and frame the Structure of such extraordinary Machines, as the Seeds of things are ; and if the immediate Creation of all the parts of Matter, was at the be-

ginning of, or rather before *Moses* his six Days, as most Men are not unwilling to allow ; it is therefore very just and Philosophical to conclude, that the most noble, admirable, and elaborate parts of Matter, the Seeds of Things, were then created too; the Words of the sacred Historian, as I have before touched, implying, that these little Bodies or most active parts of Matter, must have existed somewhere before these mentioned Days of Production ; and where could that be, but among the loose and disorder'd parts of the Chaos ?

And moreover, if we have reason to believe that these Seeds or Sperms contain in them the entire Bodies, compleatly and perfectly *in parvo*, of the Individuals to be produced ; which they evidently do in those of Plants, and by what yet appears in those of Animals too, as far as our Micrometry enables us to judge and discern into the Make and Constitution of them ; it cannot then be thought that their Littleness, they being in their Seeds as compleat and perfect Beings as in their utmost Bulks and Extension, can render them, or give us just cause to suspect them, unworthy the immediate Hand of God,
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and the peeculiar Workmanship of creating Power ; for Great or Little is equal to that, and equally becoming the Divine Work, so they be in their Kinds absolutely compleat and perfect Beings.

That the Creation of Matter, and consequently of all the parts thereof, is precedaneous to the six Days Work, many of our late Expositors conclude, and explain by reading the Word *Created* in the first of *Genesis*, not as usually in the *Perfectum*, but in the *plus quam Perfectum*, as it is frequently used in the Scripture Stile, and very common in the Hebrew Syntax ; which way of interpreting, renders the Text natural and easy ; And tho' the word *Created* be sometime used to expresse *Creation* in the most strict and grosser Sense ; yet otherwhiles it implies no more than producing, framing, making ; as is plain by several Instances in Scripture ; And therefore if *Gen. 1. 21.* be objected against the evidence of the Proposition before us, viz. That *God created great Whales and every living Creature that moveth* ; we are undoubtedly either to take the Word *Created* in the *plus quam Perfectum*, or to take it as it is promiscuously

ously used for Making or Producing ; for the next Words clearly intimate that the *Waters* produced them ; and then the Sense, that when God had created, and the Waters brought them forth, they then became great Whales, is just, natural and proportion'd to the other Acts of Production : And therefore to give the Words of *Moses* a Coherence with himself and the established *Phænomena* of Nature, the Production there mentioned, of these Creatures called *Great* on account of their vast growth, must reasonably imply, as in the other Particulars, a feminal Origination : And this way of explaining the Words of *Moses*, in reference to the different Ideas of Creation and Production, I find our great and worthy Commentator the Lord Bishop of *Ely* to make use of, who grants these Concessions.

First, That the Creation of the World, and consequently of all material Beings, was over before the six Days Works began.

Secondly, That the six Days Works were a regular and orderly Reduction of a confused Chaos, into a habitable World, without any strange Miracle, in every part of it.

Thirdly,

Thirdly, He supposes, that for a considerable time before the six Days Work began, there were such preparatory Agitations, Fermentations and Separations, and Conjunctions of Parts, as disposed the whole to fall into that succeeding Method, and to introduce the six Days Production following; of which more in Mr. *Whiston's* excellent Discourse of the *Mosaick Creation*, pag. 68.

Though this Light and Evidence from the Words of *Moses*, taken in the Sense now explained, led me to assert the Primary Origination of both the Vegetable and Animal Furniture of our Earthly Globe to be in their Seeds; yet the Theory I offer to account for the Origin of Figured Fossils, requires no more than that of Animals, and but of the Marine ones too, together, upon what has been said, with these Concessions following, *viz.*

First, That the common Matter of our Earth was once in a Fluid State and Consistence, which the *Mosaick* History proves, and the Spheroidal Figure of the Earth, supposes.

Secondly,

Secondly, That at least all Marine Animals were originally created in their Sperm or Seed in that Fluid ; which is very easie to conceive, that Element being the proper Seat and Habitation of those Creatures.

Thirdly, That on the original Separation of the thicker and thinner parts of that Fluid, the thinner became Air and Water ; and the more dense and thicker parts, gradually fixed into dry Earth ; that is, Earth, Clay, Stones, &c. which is sufficiently confirmed by the sacred Text.

Fourthly, That in the gradual fixing and coagulating of the dense and gravitating parts of that Fluid, vast Proportions and innumerable Multitudes of the Seeds of Fish, especially of the shelly Species, were hurried down, detain'd and incorporated in the strict embraces of the detruing thickning Sediments, which afterward became Earth, Clay, Stones, Minerals, &c, and were there laid up and preserved for ever throughout the substance of those depressed congealing Masses.

Fifthly, That at the first congealing of the more gross and heavy Masses and Sediments of that Original Fluid, these enclosed

enclosed Seeds or animated little Bodies, being more full of Life, and replenished with greater Activity and Vigour than the other parts of Elementary Matter; with the first Onset of their vital and plastick Motion, disposed and figured the then soft and ductile parts of their inclosing Matter, into such Forms as their peculiar specifick Exertions shot them into, and wherein they remained ever after congealed and petrified : And this we may conceive in the same or very like manner, as we observe the Salts of some Vegetables, when mixed and incorporated with Lye or Urine, to shape, direct, and figure, in a sharp Frost, the congealing parts of that Liquid into their own natural Forms and Delineations. And also that some Proportions of these Seeds, the strongest and liveliest of them, actuated so far their peculiar Ferments in that soft and ouzie Matter, as to become perfect Fish; of which the tender Musculary parts soon failing, the more firm and durable, viz. Bones and Shells, kept up their Frame and Texture, and became, upon a through Congealation, parts of those very Concrets, in which they were produc'd, and in which we find them.

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These two last *Postulata* are but Mechanical Consequences of the three preceding ones; and their Evidence depends on the Authority of them, as that does on the *Mosaick* Text.

Yet for a farther proof that Shells may be produc'd and perfectly form'd, in a much grosser Substance than we do or can suppose the Constitution of the hardest Rocks to have been before their acquiring Solidity and Hardness; that is, when their parts were yet loose, and in a sort of Fusion and Fluidity; I have oft observ'd, and sometime shew'd to my honour'd and worthy Friend Mr. *Edward Lhwyd* Keeper of the *Museum* in *Oxford*, multitudes of small very perfect Shells lying scatter'd in all Positions, and of all sizes, from the bigness of a small Pins Head to that of an ordinary Periwinkle, in the midst and throughout the Pulp and Substance of a very thick Clay or Marle: nay in one place I have seen abundance of Cockle-shells, most of them whole, their Frame strong and durable, in the midst of very tough Marle; but the others were weak and brittle and perfectly white; which are to be seen in twenty places in my Neighbourhood; on whose Circumstances and Production, for more evidence

evidence in this Matter, I shall a little insist and thus argue.

These Shells must either be feminally produced in this Marle or Clay, or convey'd there by Deluges or Inundations: the latter is very improbable, if not impossible, for their Make and Texture, I mean the first ones I mention'd, is so thin, light and friable, that the least Undulation, or hitting of them against other Bodies, would have bruised them to pieces; and they lie generally, if not all, in their adapted Cavities, whole and entire; neither is there any cause to suspect their having sunk, or in any manner made their way into these thick Beds of Clay; there appearing not the least Tokens of such a Passage.

So that we must conclude them to have been generated there; but then, whether originally produc'd there at the first *Coagulum* before mention'd, or afterwards sprouting out of their interspersed and latent Seeds from time to time, as certain Causes concurr'd to give them Birth and Production; is a Point may deserve a little consideration.

First, That these Shells were not produc'd in their perfect Shapes, Magnitudes and Dimensions at or before the first

hardning of the Marly Substance, we have reason to presume; because the Composition of them is so dilute, their Frame and Texture so weakly built and unstable, that the necessary Pressures of the closing and hardning Mass, would have utterly ruin'd their Frame and Structure, many of them being but a thin Film of a finely dilated Calx, form'd into Shells, but so brittle, that they can scarce endure the fingering of them; and therefore as this Diluteness and Feebleness of their Frame, is a good Argument to prove they were not thrown there by any Floods, which would have dashed them to pieces; so is it a proof likewise that they were not produced into the Form and Substance we see, before the hardening of the including Mass: Therefore we may hence in the *Second* place conclude them to have grown and sprung out of their latent Seeds in those places, after the settling and congesting of the Marly Substance: But how to account for their so doing, in so hard a Substance; I mean hard, in comparison of their tender Bodies; is another difficulty.

To the unfolding of which, I conceive, that that sort of Marle being of a porous
spungy

spungy Texture, was perhaps at first after its settling, full of Bloats and little Holes, replenish'd with a saline Juice ; at which the spermatick little Bodies, interspersed through the whole Mass, blooming and putting forth their Increase and Vegetation, soon filled the *Uterus* or Cavity with an Animal Shell ; and the Vegetative Ferment depredating and converting the Ambient Matter into its own Substance, not only encreased the Shell, but also enlarged the Cavity, for the growth and augmentation of it. Which Process may appear probable, since 'tis evident that these Shells must be form'd there sometime after the Marle's acquiring its hard and settled Consistency ; and even in the thickest of it there are little fibrous Pipes or Conveyances, through which the animated Products of the Marle may be well conceived to receive Air and Moisture enough to sustain and accommodate them in their Growth and Maturity.

I insist the more on this *Phænomenon*, that the Proposition before us may appear more conceivable and easie ; instancing in these Marly Shells, the visible Notes and Indications of just the same Process of Generation, as the said Proposition

position supposes ; for it supposes no more than I have, I think, easily and mechanically accounted for in these Marly Shells ; that on the like reason the same Effects might be well attributed to the same Cause and Circumstance. Now from all this, it is just and natural to infer, and I presume few or none will gainsay, that *First*, if the production of these true and undoubted Shells in thick Clay or Marle, sprouting out of some hidden Seeds incorporated with the Marle, as certain Causes concurr'd to give them birth, seems possible, nay probable, and almost evident, to any one who views them in their Marly Cells and Receptacles, and duly weighs their Circumstances ; it will reasonably follow, that it is as possible, nay as probable, that those Shells now included in Chalk, Stone or Marble, or any the hardest Substances, might be, and were produced just in the same way, or one not very different from it, at that time when these now-harden'd Masses were in their original Clays and Softnesses.

Secondly, It will from this instance follow also, that if the Marine Animals were created in their Seeds or Sperms, (of which the crustaceous and testaceous sort are a considerable Species) in the Cha-
otick

otick Fluid ; and if this Fluid in which these Seeds floated, had a great and considerable share of it, by the Divine Appointment condensing and subsiding into such spiss and dreggy Consistencies, as afterward came to be Earth, Clay and Stones, which I take to be sufficiently authorised by the *Mosaick* Accounts ; it will be from hence very plain and easie to conceive, and as reasonable to infer, that many of these Seeds and Sperms so subsiding, were detached and carried down in those thick congealing Juices ; where during the fused and yielding Consistency of them, they were in no incapacity of displaying and actuating their Animal Ferments ; Now let us reflect and observe here, that if in the instances I have now made use of, these mention'd Shells found in Clay and Marle, may not be judged to pretend to any other Origin than a feminal Production in those very Clays where they're found enclos'd, whether the very same Reason will not oblige us to make the same Account of the Origin of those other Shells, found in the same manner in Rocks and Stones ; for since the Original of these two Subjects, *viz.* Clays and Stones, was the same, why may we not ascribe the production of

of these Fossil-Shells to one uniform Cause, in both these Subjects ; that is, to those Original Seeds, dispersed in the engross'd Earthy Matter ; part whereof by the concurrence of certain Causes came to be congealed and petrified unto a stony hardness ; and the other part, for want of such Causes, still continuing in their clayey state and condition ? I shall yet go one step further, and only ask such as are averse to this Opinion ; if they allow these Shells in Marle and Clay to be the undoubted Products of that including Mass, and yet will deny the other Shells found in Rocks and Stones to have been spermatically produced in those Masses ; and if it should so happen, that part of that clayey Mass abounding with these Shells, be turn'd to Stone ; which some petrifying Steams or Waters may easily effect : I say, whether in that turn of Circumstance, these Persons, on the Principles they go, will not be thereby induced to deny what before they easily granted ; when indeed the pretended Difficulty is founded on no essential difference, but on what is only a Mode or Accident, *viz.* the Laxity and Density of the same Subject.

F I N I S.

